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## Understanding and applying visual thinking in a doctoral context

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## **Understanding and Applying Visual Thinking in a Doctoral Context**

This paper is an account of a study conducted to collect experiential responses from the design field to develop a transparent definition of the role of intuition and its place in decision making for designers. The objective is to communicate the type of techniques that have collectively formed a method for coping with and communicating multi-sensory information, delineating the subtle differences in employment of visual thinking and the visual language. Findings present challenges for developing new forms of analysis using visual thinking with an intention to re-connect them through rhetorical reasoning with more diverse literature and existing knowledge.

### **Introduction**

A central challenge for design research is to seek knowledge that expands and refines the designer's self awareness enabling him or her to make more informed judgements about values and goals, where the qualities of judgement and experience are subjects in their own right requiring analysis and cultivation. Richard Buchanan suggests that the essence of design knowledge lies in understanding and applying the principles and methods of design, and defines design as, "the human power of conceiving, planning and making all of the products that serve human beings in the accomplishment of their individual and collective purposes."<sup>1</sup> For design thinking to be transferable and verifiable the significance of this ability must be made explicit. Margolin compounds this position and suggests that if, "designer's are going to realise the full potential of design thinking, then this thinking must be extended to consider how the situations in which design occurs are themselves designed."<sup>2</sup>

In response to these needs which have been voiced from varying perspectives within the field of design throughout the last decade<sup>3</sup>, this research is concerned with transparent communication of the relationship between rhetorical reasoning and visual thinking through exploration of intuition and its place within decision making for designers.

Rhetorical reasoning integrates information. It integrates theory and practice and it integrates knowledge from a diversity of domains. The essentially rhetorical nature of design is

fundamental, as it is the designer's approach to problem solving. In the attempt to find a solution, a designer's approach to understanding a problem involves tacit awareness and acknowledgement of the divergent elements within. Decisions regarding one aspect of a problem directly affects all others, and together these issues have implications on the overall result. Every action a designer takes results in reactions, which have reverberations on the whole framework of the design process.

Designing involves 'looking', 'listening', and 'reading': allowing collective thoughts to levitate, to sit suspended in the mind and to be given space, through time, to develop as the process of problem solving unfolds<sup>4</sup>. This suspension of thought allows a pattern to evolve, providing designers with a picture, which depicts the inter-relationship(s) between different and often contrasting elements of a problem. Within the context of design, the process of rhetoric is given an added dimension when integrated with divergent thinking. The inter-related pattern created through rhetorical reasoning becomes non-linear.

The focus of this paper is an account of a pilot study in which 5 Scottish designers from the areas of graphic and industrial design were interviewed. The objective is not to report results in detail but to point to the challenges; the type of questions that have arisen; and the type of techniques that have collectively formed a method for coping with and communicating multi-sensory information.

### **Context for the Pilot Study**

Design can be ambiguous, particularly when attention is focused upon the diversity of specialisms within the field and differences of approach to process which can emphasis (for example) technological and materialistic, environmental or cultural aspects. These elements are concerned with descriptive definition of practice rather than formal definition of the knowledge base supporting design. Ambiguity is essential to not only to description of the field but in interpretation of the thinking within.

Ambiguity exists because it is an essential state for design thinking and reasoning as it presents the environment which allows a designer to identify and 'see' connections. It relates to both the holistic approach of a designer's thinking and the conditions within which non-linear, rhetorical reasoning exists. The designer's role when working integratively is to attain and maintain (at least in part) this condition throughout the problem-solving process. As Buchanan notes, "Ambiguity suggests uncertainty, and uncertainty leads to inquiry. If one is curious and interested in the subject, questions arise. Out of questions, problems may be discovered. Out of problems, framed with progressive refinement, comes research, theory and the beginnings of deeper understanding."<sup>5</sup>

However, it is not the state of ambiguity that deals with connections once they are made, rather it is a designer's use and understanding of intuition that deals with the connection: how they relate and inter-relate with one another. Ambiguity is what designers are dealing with, therefore it cannot be the tool that a designer uses - intuition is the tool. Subsequently the question arises - how do designer's work with this tool? In order to work with a tool one must have a level of understanding and experience gained through practical application, which triggers the question: what is a designer's understanding of intuition? To begin answering a question of this nature, consideration must be given to how information can be collected and where does analysis of multi-sensory information within design thinking begin?

### **The Role of Intuition**

Intuition is viewed as a mindful quality and portrayed as a fundamental element of creativity. Langer, drawing from Wordsworth's 'Tintern Abbey', presented intuition as, "relatively effortless...reached by escaping the heavy, single minded striving of the most ordinary life."<sup>6</sup> To describe intuition as effortless undervalues its significance within a creative process. While intuition cannot be forced it is arguably not an effortless activity. However, the ability to integrate and understand the role of intuition within the creative process progressively develops to the point where it can be employed with great ease.

There are two internal activities associated with intuition: procedural and experiential. Both are subjective in that they are dependent upon an individual's respect for, and approach to using intuition. It is the individual's willingness to compare conditional truths with probability statements gathered from situations, environments, people and/or objects. This attuned information is not perceived by most subconscious minds. Indeed, the dynamic nature of intuition i.e. continual motion and change results in feelings of uncertainty and as, "uncertainty may be more natural to some of us than others, an individual's willingness may be curbed."<sup>7</sup>

A mindful person takes action based on their personal perceived competencies and can be viewed as a risk taker because these competencies exceed someone else's estimation. Mindful is the state of being derived from mindfulness: it is a construct of the mind. The results of mindful actions are important as not only does change become possible but also the range of responses enlarges. With mindfulness comes increased control and the ability to prevail seemingly fixed situations.

### **Mindfulness and Creativity**

There are a multitude of parallels between mindfulness and creativity. Both are process rather than outcome orientated activities, and within them there are two contrasting thinking

approaches: analyses and synthesis. Mindfulness implies openness to and awareness of multiple perspectives with a flexibility and responsiveness to new information. Creativity is an ability to open oneself to new information, surprise and uncertainty, and to play with perspective and context. It is the continual creation of new categories derived from paying attention to a situation and its context.

Opening oneself to new information has a dual perspective: internal and external. It is concerned with changing the inner self by removing (for example attitudinal) constraints, and by encouraging the receptivity to ideas of others. This double dialogue is a feature of much of Bohm's work. Margolin draws attention to this aspect also and notes, "Commentary is essential to a pluralistic research community. Its function is to critique, validate, and frame differences and debates. Commentary recognizes the contingency of the research enterprise itself. It is central to the enterprise and not subordinate to a hegemonic theory of practice that relegates its discursive methods to a marginal position."<sup>8</sup>

### **Applying Visual Thinking**

The role of visual thinking within this research is twofold: it is used to understand theory within practice, and it is also used to conduct practice in order to understand theory. Applying visual thinking from both perspectives is intrinsic to the identification of gaps within and between communication of design thinking. An early part of the doctoral study involved collection of information from eight design specialisms in order to communicate how designers integrate information from a diversity of domains during the act of problem solving, and to identify questions leading to the significance of this ability for other disciplines. Using a quantitative approach to second year Bachelor of Design (Hons) students from the School of Design, University of Dundee, data was collected to present the diversity of design methods and techniques (general and specific) in order to understand where the complexity of a designer's thinking existed. (Figure 1a & 1b present an overview of the research, where the information in figure 1b is expressed as a map).

Data was collected in a non-interventionist manner and the researcher did not participate in any way in the conduct of the studies. However reflecting on the data as it was gathered and thereafter influenced the design of a small pilot study. In a detailed perusal of the existing literature, selected material also had an influence on the design of the pilot study. Visual thinking was employed when conducting aspects of the literature review in order to interpret and understand what was being communicated through textual description from a different knowledge domain. The visual language was used as a method of communication; a thinking and reasoning tool, for criticism and discovery of both the visual and textual information; and

as a technique to support lateral transformation. Together, this material and the material gathered from the non-participatory case study were integrated into the method of interview adopted in the pilot study.

### **Pilot Study**

Exploring decision making for designers, study focused upon the physical and emotional experience of being a designer. Collecting responses for construction and development of a transparent definition of the theoretical position of intuition, the purpose was to understand how designers through their visual thinking communicate the concept.

5 leading Scottish graphic and industrial designers were interviewed. Each participant held a position of authority, level of expertise and visual approach to thinking. In acknowledgement of the importance of intuition within the process of design thinking and awareness of the concept being sufficiently abstract and unexplained, intuition was used as a ground for discussion. Each individual interview was treated as an independent study with no attempt made to integrate them into a sample of designers as a whole. Visual thinking was intrinsic to both the interview process and to the manner with which a design Ph.D must present itself.

Methods adopted in this study accept the advice of Arnheim who notes that visual methodology must not sacrifice the full context of the image as a whole in order to obtain a self contained description of each component. To take a reductive approach, the research while gaining analytical exactness would have to content itself with an approximation of the true phenomenon. Arnheim also advises that while an intuitive perception can convey the experience of a structure (and in the pilot study, the structure was design thinking) it does not offer intellectual analysis.<sup>9</sup> As the process of structuring occurs to some extent below the level of consciousness, intuition does not always make sense, but to analyse intuition through logical thought can silence vital information.

Buchanan has pointed out that design must be careful to develop methods of exploration that do not lose the qualities that distinguish it. He argues that, “no other field has the same identity and distinct purpose in seeking knowledge,”<sup>10</sup> that characterises design knowledge. As analysis is a method where linearity prevails and a process in which the environment is fixed, where categorises are rigid and ‘experience’ is held constant, it was therefore not appropriate to use quantitative analysis of the pilot study to interpret designers communication and understanding of intuition.

Due to the multi-sensory nature of intuition, the visual language was used as a vehicle for unpacking complex information in stages. Information was collected through both verbal and

visual expression. The role of sketching was employed as a communication technique: a catalyst for questioning during conversation. Drawing was incorporated as a means of responding to questions, as it was understood to be a tool for critical reflection, supporting a designer's approach to thinking and reasoning.

### **The Application of Mind Mapping**

Mind mapping was chosen to relieve the 'silencing of vital information' and used during analysis of intuition both as a note-taking and note-making technique. Supporting the application of divergent thinking within doctoral study, it aided the planning and organisation for the form, content and structure of the interviews. Indirect questions were constructed with regard to the general nature of intuition; its place in decision making for a designer; and communication of the role of intuition to non-designers. Direct questioning with reference to the specific and individual experience of working with the tool could not be planned. However, to alleviate ambiguity due to the abstract nature of possible responses, part two of the interview was designed to collect information via visual expression from an integrative and reductive perspective.

Mind mapping encouraged immediate clarification of thought regarding a candidate's response to the physical and emotional experience of *being* a designer. It highlighted subtle paradoxes within responses during the interview enabling the researcher to make connections with seemingly unrelated elements and subsequently allowing the nature of question to shift from general to specific. The following note-taking mind map (figure 2) constructed during the process of interview, and extracts from the dialogue indicate the method by which information was elicited from one participant (A).

When the dialogue reached point 1 on figure 2, the following discussion took place: ('R' represents the researcher and 'P (A)' represents participant A).

- R     *Do you associate a particular shape with intuition?*
- P (A)   No. They're just things contained in.
- R     *Can I ask you to explain what you mean by 'contained'.*
- P (A)   I always use a kind of you go to this dark place which is you shut your eyes and it's like projecting things onto it. That surface tends to be black, and whatever you'd put on an easel it's a square, a rectangle, it changes.
- R     *'It' changes - the shape changes?*
- P (A)   The shape changes yes. Well no I would say it's a frame, it's always framed so it's either square or a rectangle.
- R     *While you were drawing that you said it was a cube. A cube implies volume. Is the contained frame 2D, 3D, or 4D?*
- P (A)   Well visually....it must be 4 dimensional - it doesn't exist any other way.

- R *What is your understanding of 4-dimensional?*
- P (A) 4-dimensional to me, what does that mean - the realm that appears first.  
Pause  
No. I say a cube. I suppose if this cube of mine had a picture in it, it would be almost like this room. From your point of view coming in there it would be these three walls.  
Pause  
Sometimes if you sit in a directors chair looking at three screens, or in a room like this looking at three walls
- R *Do you see intuition as an environment rather than a shape?*
- P (A) Yes

This technique allowed for the use of preconceived questions to open up a dialogue in which both the researcher and participant moved freely into unexplored areas. For example when asked if there was an alternative term used to discuss the principle of intuition within design, participant B, replied, "No". What followed almost immediately was a short unprepared dialogue:

- P (B) "I am always experimenting...going beyond the boundaries...and it's a form of play...a lot of ideas come out of these (playful) experiments...and to me it's exciting...when you get the 'sparks'
- R Do you go back to your 'house'?
- P (B) Yes. The house I actually in my mind conjured up because I want to start designing maybe pieces of furniture. What would the setting be? So what I see in my mind's eye is a front door...very contemporary piece of architecture...and I open up the door...and I can walk right through the house. I've never been through the house because there are so many things in it, and the thing is I pick up and I see things - pieces of sculpture. I know this house obviously doesn't exist, but it exists in my mind...there are objects and I can see these objects and sometimes you've got to really focus on them...and you might pick up on something of it...
- Pause
- R *How does it feel walking through the 'house'?*
- P (B) Well as I said I have never been all through it, and obviously when I go back it has all changed. I always start with the front door and it's the same. If I start concentrating and I open the door it's fantastic...It's quite strange, when I am there it is almost like I am physically there, although it is because I can go so deep into that...creative side. I think that is why I do it at night time because during the day there are so many things going on around you to interrupt, to disturb.

Mind mapping was also used at the intermediate stage of analysis, developing the note-taking to note-making, allowing all of a participants ideas to be pulled together to form the, "whole knowledge picture."<sup>11</sup> It promoted the identification of key aspects, words and quotations, demonstrating clearly to the researcher how they related to one another. On



reflection of each interview, a mind mapping process was followed, (for example, 15 individual maps to collectively) present a full overview of the (75-minute) dialogue. Figure 3 demonstrates a result from this stage.

The mind mapping technique aided clarification of information in general and identified significant elements within each interview. It was the visual technique used by the researcher during interview and was appropriate for providing an external perspective of the experience of intuition. However, during part two of each interview, sketching was the tool with which participants were asked to respond in order to provide an internal perspective.

### **Sketching as a Tool**

Participants were encouraged to adopt the method of sketching as it is a primary thinking and reasoning tool for designers. As the notion of intuition is abstract and complex sketching was encouraged to identify and recall relevant knowledge regarding their experience of working with and using intuition. Also, fundamental as a kind of dialogue, sketching was employed to promote emergent features and properties of the principle.<sup>12</sup>

In an interview with participant B, when the discussion was focused on visual communication of their understanding of the concept of intuition, the following sketch was presented as a means of expressing the notion of integration (Figure 4).

Whilst drawing, the participant did not converse until the sketch was completed. Only then did dialogue with the researcher continue. During this discussion participant B talked through the drawing whilst making reference to an earlier part of the interview where a description of the, 'mind's eye' was given. "I've got walled gardens or perhaps a garden that is keeping everyone else out...only I can get through...and so I have a doorway. I have to set time aside...the clock is a representation of time...once I go into this [darkness, inner self] and get through into this surroundings and into my mind's eye...in this area, this is where everything works for me. All the knowledge, information, experiences I've gathered throughout my years...or it's come with me. Then from all this here, it's all working inside my this [mind's eye], little pieces of inspiration, intuition. This is me...this is the explosion where it all comes together...and the excitement...that's why I don't sleep at night."

A significant aspect worth appreciating was that the interviews incorporated examples of both integrative and reductive approaches. Figure 5 indicates the form and content of information collected from a reductive perspective where the designer's thinking was reduced to individual elements. The results from this approach provided a valuable perspective on intuition and also presented information from internal and external positions. Observation of

the two types of sketch clearly shows that a reductive approach while providing valid information, fails to communicate how each element relates within design thinking and the nature of the environment in which they collectively or individually sit. By isolating elements of a designer's thinking you lose the qualities that distinguish them, namely intuition and ambiguity.

## **Conclusion**

5 interviews; 8 individual or sets of sketches (where a set of sketches included 2 or more which followed one another rapidly in execution); approximately 200 mind maps and 9 hours of dialogue were collected. As with all studies of this nature, the information collected far exceeds the amount which can be processed at one time.

Early part of the paper demonstrated that mind mapping was a useful means of capturing the essence of a larger amount of information without losing the connectivity. Mind maps are essentially two-dimensional and the technique used for analysis of multi-sensory information developed initial inquiry. However the mind maps failed to communicate the non-linear rhetorical reasoning of design thinking and were subsequently limited to forming a basis for further development.

Two types of visual were collected during the pilot study to provide information regarding a designer's procedural and experiential perspective of intuition. Due to the varying qualities of information collected, analysis requires different approaches, which are specific to the form and structure of each. This presents challenges for developing new forms of analysis using visual thinking. Following initial reflection of visual data in context with design theories, the work is now being re-connected with more diverse literature and existing knowledge. The strength of the work lies within integration of the results. As the relationship between holistic and reductive approaches is complex, it cannot be viewed from one perspective. Findings reveal that complexity lies within and between the dual perspectives and that understanding the relationship between these four perspectives through the practice of research is key to capturing an aspect of design knowledge.

## **Notes & References**

<sup>1</sup> Buchanan, R. "Design Research and the New Learning." In *Researching Design: Designing Research*. London: London Design Council, 2000.

<sup>2</sup> Margolin, V. "History, Theory and Criticism in Doctoral Design Education." In R. Buchanan et al (eds.) *Doctoral Education in Design 1998: Proceedings from the Ohio Conference* Pittsburg: Carnegie Mellon University, 1998, 197-224.

<sup>3</sup> See several of the papers contained in both *Doctoral Education in Design 1998: Proceedings from the Ohio Conference*, and *Doctoral Education in Design: Foundations for the Future 2000*.

<sup>4</sup> The dialogue of design was viewed as exploratory, rhetorical, and reflective. A review of David Bohm's theory of 'Dialogue' noted a direct relationship between the activities of Design and Dialogue. See, for example, *On Dialogue*. London : Routledge, 1996.

<sup>5</sup> Buchanan, R. "The Study of Design: Doctoral Education and Research in a New Field of Inquiry," (Pittsburg: Carnegie Mellon University, 1998), 1-32.

<sup>6</sup> Langer, E. J. *Mindfulness*. Reading, Massachusetts: Merloyd Lawrence, 1989.

<sup>7</sup> Ibid

<sup>8</sup> Margolin, *op.cit*: 205

<sup>9</sup> Arnheim, R. "A Plea for Visual Thinking." In W.J.T. Mitchell *The Language of Images*. Chicago, London: University of Chicago Press, 1980, 171-79.

<sup>10</sup> Buchanan, *op.cit*: 18

<sup>11</sup> Buzan, T & B. *The Mind Map Book*. London: BBC Worldwide Limited, 2000.

<sup>12</sup> Cross, N. "Natural Intelligence in Design", *Design Studies*, Vol. 20, No.1, (1999), 25-39

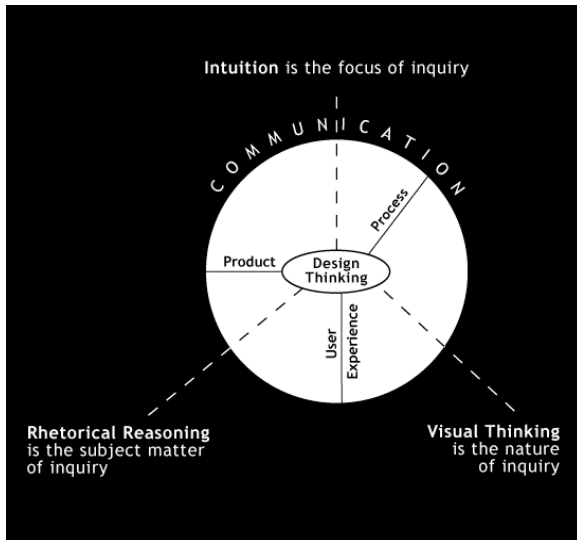


Figure 1a: General outline of Ph.D inquiry

Figure 1b: A more detailed description regarding researcher's approach to inquiry and current position within the Ph.D

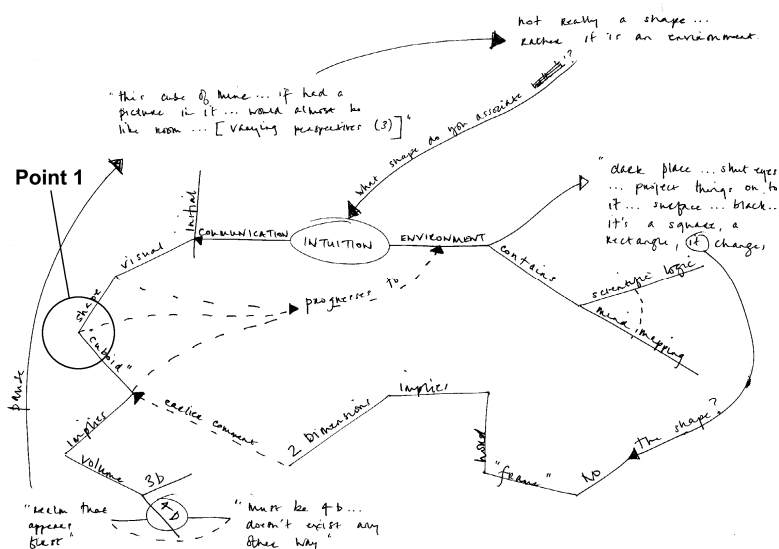
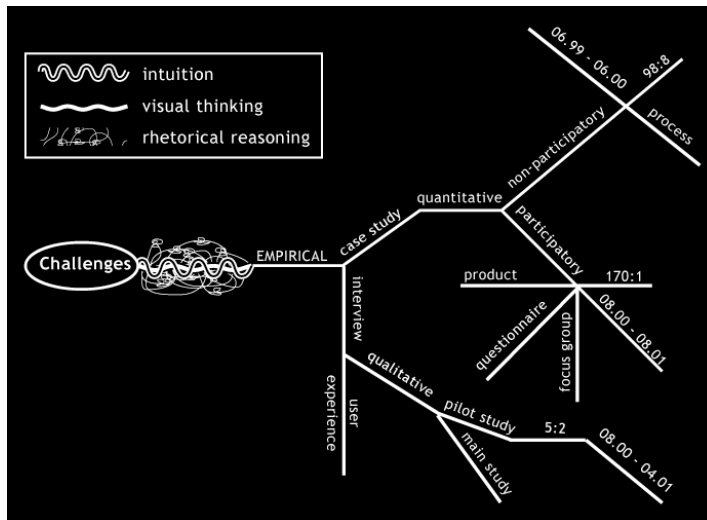


Figure 2: Researcher's note-taking mind map produced during the method of interview

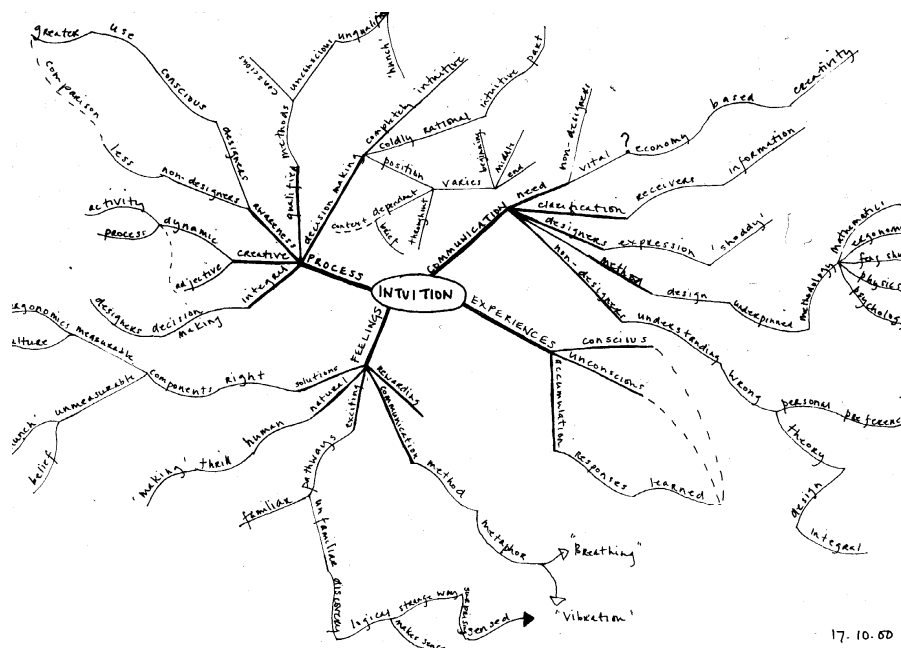
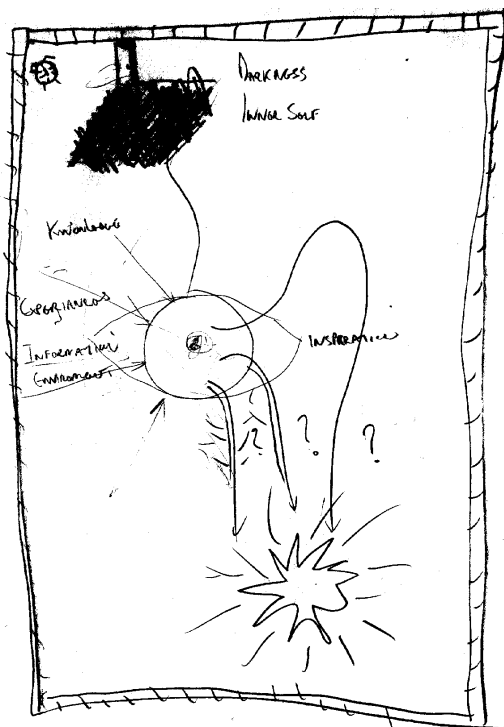


Figure 3: Researchers note-making approach to reflection for the method of interview








Element	Colour	Drawings	Shape
Intuition	Sky Blue		Oval, Circle
Dynamic Visuals	Hol Red		Zig Zag
Cultural Information	Grey		Ameriba
Sensorial Information	Softer Pink		web
Research	Bright Clear Yellow		Square, Triangle

Figure 5: Matrix reflecting individual components of participant D's thinking

### Biographical Note

Louise Valentine is a doctoral student at the School of Design, University of Dundee. She graduated in 1995 with B.A. (Hons) Industrial Design from Heriott Watt University, Edinburgh and was awarded a Master of Design degree in 1998 from the University of Dundee. Louise's doctoral research began in 1998 and is due for submission in December 2001.

Seaton Baxter is Honorary Professor at the School of Design, University of Dundee and Emeritus Professor at the Robert Gordon University, Aberdeen. Trained initially as a building surveyor he then worked for 20 years in agricultural research on the influence of design on farm animal welfare. In 1983 he became Head of the School of Surveying at RGU and later an assistant principal and Dean of the Faculty of Design. In 1993 he returned to research and teaching and set up the Centre for Environmental Studies and the first MSc course in Ecological Design. He is associated with several voluntary environmental organisations in Scotland and in 1998 he was honoured for his services to Scotland's natural heritage. His current interest at Dundee is in a new concept of Natural Design.